

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. **(Currently amended)** A circuit to control the capacitance of a variable capacitor in a strictly linear mode through a steady tuning voltage and to achieve a high Q-factor at the same time; comprising:

a set of individual small capacitors;

a set of capacitor switching stages, each stage comprising;

a switching device, allowing a steady ramp-up/ramp-down phase between the points of being fully switched on and fully switched off, and where said switching device is connected in series with one of said capacitors, to connect a multiple of said capacitors in parallel;

a circuit to control the switching operation of said switching device in a steady ramp-up/ramp-down manner between the points of being fully switched on and fully switched off, comprising:

a translinear amplifier to produce a ramp-up/ramp-down signal for said switching device, where said translinear amplifier is

implemented within said circuit to control the switching operation;

a common circuit to ~~individually~~ provide a set of input and output reference levels for each of said capacitor switching stages, ~~building the~~ used as input reference levels and the output reference levels for each of said translinear amplifiers, comprised within said ~~capacitor switching stages~~ circuits to control the switching operation; and

an input signals, each dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, provided to the an inputs of all of said capacitor switching stages.

2. **(Previously amended)** The circuit of claim 1 wherein said switching device with steady ramp-up/ramp-down phase is a FET transistor.
3. **(Previously amended)** The circuit of claim 2 wherein said switching device with steady ramp-up/ramp-down phase is a P-channel or N-channel junction FET.
4. **(Previously amended)** The circuit of claim 2 wherein said switching device with steady ramp-up/ramp-down phase is a PMOS or NMOS FET.
5. **((Previously Canceled))**
6. **(Previously amended)** The circuit of claim 1 wherein said circuit to generate a set of input\_reference\_levels, one for each of said capacitor switching stages, is implemented as a chain of resistors.
7. **(Original)** The circuit of claim 1 wherein said translinear amplifier has a gain of 1, the typical gain of translinear amplifiers.

8. **(Previously amended)** The circuit of claim 1 wherein said translinear amplifier has a gain differing from 1, which gives one more degree of freedom to optimize the operating parameters by making the steepness of the switching device's gate control voltage versus tuning voltage adjustable through proper gain selection, thus making the overlapping of capacitor switching operation independent of the selected distance of the switching points of adjacent capacitor stages.

9. **(Previously amended)** The circuit of claim 1 wherein said circuit to provide a signal, dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, is a single signal connected to all of said capacitor switching stages.

10. **(Currently amended)** The common circuit of claim 1 ~~wherein said circuit to provide said set of input and output reference levels for each of said capacitor switching stages, building the implements said output reference levels of for said translinear amplifiers, is implemented by a single signal, connected to all translinear amplifier's output reference points in common.~~

11. **(Original)** The circuit of claim 1 wherein said capacitors are discrete capacitor components.

12. **(Previously amended)** The circuit of claim 1 wherein said capacitors are manufactured on a planar carrier, separate from the circuit carrier.

13. **(Original)** The circuit of claim 1 wherein said capacitors are integrated on a semiconductor substrate, but on a separate substrate than said switching devices and amplifiers.

14. **(Original)** The circuit of claim 1 wherein said capacitors are integrated on a semiconductor substrate and on the same substrate as said switching devices and amplifiers.

15. **(Original)** The circuit of claim 1 wherein said capacitors are manufactured as a Metal-Oxide structure.

16. **(Original)** The circuit of claim 1 wherein said capacitors are manufactured as a junction capacitor.

17. **(Currently amended)** A circuit to control the capacitance of a variable capacitor in a strictly linear mode through a steady tuning voltage and to achieve a high Q-factor at the same time, by controlling a multiple of switching devices through steady control signals when said switching devices operate within their steady ramp-up/ramp-down area and by sharply cutting off the control signals,

when said switching devices operate outside their steady ramp-up/ramp-down area; comprising:

- a set of individual small capacitors;

- a set of capacitor switching stages, each stage comprising:

- a switching device allowing said steady ramp-up/ramp-down phase between the points of being fully switched on and fully switched off, and where said switching device is connected in series with one of said capacitors, to connect a multiple of said capacitors in parallel;

- a circuit to control the switching operation of said switching device in a steady ramp-up/ramp-down manner, comprising:

- a translinear amplifier to produce a steady ramp-up/ramp-down signal for said switching device, where said translinear amplifier is implemented within said circuit to control the switching operation;

- a first cut-off circuit to drive said switching device to a fully on status, when said switching device operates outside said steady ramp-up/ramp-down area on said switching device's low resistance side, and implemented in combination with said translinear amplifier;

- a second cut-off circuit to drive said switching device to a fully off status, when said switching device is beyond said steady ramp-up/ramp-down area on said switching device's high resistance side, and implemented in combination with said translinear amplifier;

a common circuit to ~~individually~~ provide a set of input and output reference levels for each of said capacitor switching stages, ~~building the~~ used as input reference levels and the output reference levels for each of said translinear amplifiers, comprised within said ~~capacitor switching stages~~ circuits to control the switching operation; and

~~an~~ input signals, each dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, provided to an input of all of said capacitor switching stages.

18. **(Currently amended)** The circuit of claim 17 wherein said first cut-off circuit to drive said switching device to a fully-on status, when said switching device operates outside its desired steady transition area on the lower resistance side is provided by additional circuit elements, working as a signal cutoff function.

19. **(Currently amended)** The circuit of claim 17 wherein said a second cut-off circuit to drive said switching device to a fully-off status, when said switching device operates outside its desired steady transition area on the higher resistance side is provided by additional circuit elements, working as a signal cutoff function.

20. **(Currently amended)** The first cut-off circuit of claim 18 ~~wherein said signal cutoff function~~ to drive said switching device to a fully-on status, when said switching device operates outside its desired steady ramp-up/ramp-down area on

said switching device's low resistance side, is implemented as a signal cutoff function within said translinear amplifier circuit.

21. **(Currently amended)** The second cut-off circuit of claim **19** ~~wherein said signal cutoff function~~ to drive said switching device to a fully-off status, when said switching device operates outside its desired steady ramp-up/ramp-down area on said switching device's high resistance side, is implemented as a signal cutoff function within said translinear amplifier circuit.

22. **(Original)** The circuit of claim **17** wherein said translinear amplifier has a gain of 1, the typical gain of translinear amplifiers.

23. **(Previously amended)** The circuit of claim **17** wherein said translinear amplifier has a gain differing from 1, which gives one more degree of freedom to optimize operating parameters, like overlapping of capacitor switching operation and signal cutoff at the edges of said steady ramp-up/ramp-down area.

24. **(Previously Canceled)**

25. **(Previously Canceled)**

26. **(Currently amended)** A circuit to control the capacitance of a variable capacitor in a strictly linear mode through a steady tuning voltage and to achieve a

high Q-factor at the same time, by controlling a multiple of capacitor switching devices through steady control signals and by compensating the temperature deviation of said capacitor switching devices; comprising:

- a set of individual small capacitors;

- a set of capacitor switching stages, each stage comprising:

- a switching device allowing a steady ramp-up/ramp-down phase between the points of being fully switched on and fully switched off, and where said switching device is connected in series with one of said capacitors to connect a multiple of said capacitors in parallel;

- a circuit to control the switching operation of said switching device, in a steady ramp-up/ramp-down manner, comprising:

- a translinear amplifier to produce a control signal for said switching device, and implemented within said circuit to control the switching operation;

- a temperature compensating circuit to compensate the temperature deviation of said switching device, and implemented ~~within~~ connected to an output reference point of said circuit to control the switching operation;

- a common circuit to ~~individually~~ provide a set of input and output reference levels for each of said capacitor switching stages, ~~building the~~ used as input reference levels and the output reference levels for each of said translinear amplifiers, comprised within said ~~capacitor switching stages~~ circuits to control the switching operation; and



an input signals, each dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, provided to an input of all of said capacitor switching stages.

**27. (Currently amended)** The circuit of claim **26** wherein said temperature compensating circuit to compensate the temperature deviation of said switching device is provided by feeding a modified reference voltage to said translinear amplifier's output reference point, to mirror a temperature correcting signal into the control signal of said switching device.

**28. (Currently amended)** The circuit of claim **27** wherein said temperature compensating circuit to compensate the temperature deviation of said switching device, uses a device of the same type as said switching device itself, to produce an exact equivalent of said temperature deviation.

**29. (Previously Canceled)**

**30. (Currently amended)** The circuit of claim **1** wherein said common circuit to individually provide said input reference levels for each of said capacitor switching stages, generates a set of reference values, one value for each capacitor switching stage, in a non-linear relation between said tuning voltage and said input reference levels.

31. **(Currently amended)** The circuit of claim 30 wherein said common circuit to individually provide said input reference levels, for each circuit to control the switching operation in a non-linear relation between said tuning voltage and said input reference levels, is provided by specifically selecting the steps of a set of reference values in a way, to achieve said desired non-linear relation.

32. **(Currently amended)** The circuit of claim 31 wherein said common circuit to generate said set of input reference levels, one for each of said circuit to control the switching operation in a non-linear relation, is implemented as a chain of resistors.

33. **(Currently amended)** A method to control the capacitance of a variable capacitor in a strictly linear mode through a tuning voltage and to achieve a high Q-factor at the same time; comprising:

providing a set of individual small capacitors, a set of capacitor switching stages, each comprising: a switching device allowing a steady ramp-up/ramp-down phase between the points of being fully switched on and fully switched off, and where said switching device is connected in series with one of said capacitors, to connect a multiple of said capacitors in parallel, a circuit to control the switching operation of said switching device in a ramp-up/ramp-down manner between the points of being fully switched on and fully switched off and comprising a translinear amplifier, ~~and a~~ common circuit to ~~individually provide a set of input reference levels~~ and output reference levels for each of said capacitor switching

stages, and ~~an~~ input signals, dependent on the tuning voltage, and dedicated for the voltage controlled capacitance change ~~and provided to all of said capacitor switching stages;~~

providing ~~an~~ individual input reference level and an output reference level for each ~~individual~~ capacitor switching stage;

supplying one of said signals, dependent on the tuning voltage, dedicated for the a voltage controlled capacitance change, to all of said capacitor switching stages;

amplifying, by means of said translinear amplifier, a difference of said tuning voltage and said input reference level within each capacitor switching stage, to produce a linear control signal for a ramp-up/ramp-down switching operation;

fully switching on one of said switching devices in order to completely switch one of said small capacitors in parallel to the already switched on capacitors, one after the other to linearly increase the total capacitance;

fully switching off one of said switching devices in order to completely disconnect one of said small capacitors from the other switched on capacitors, one after the other, to linearly decrease the total capacitance; and

ramping up or ramping down the switching operation of one of said switching devices to partially switch, with increasing or decreasing share, one of said small capacitors in parallel to the already switched on capacitors, one after the other.

34. **(Previously amended)** The method of claim **33** wherein linearly controlling the switching operation applies to a FET transistor as the switching device with steady ramp-up/ramp-down phase..

35. **(Previously amended)** The method of claim **34** wherein linearly controlling the switching operation applies to a P-channel or N-channel junction FET as said switching device with steady ramp-up/ramp-down phase.

36. **(Previously amended)** The method of claim **34** wherein linearly controlling the switching operation applies to a P-channel or N-channel MOS FET as said switching device with steady ramp-up/ramp-down phase.

37. **(Currently amended)** The method of claim **33** wherein individually providing said input and output reference levels for each individual capacitor switching stage, generates two sets of reference values, one set of input reference levels and one set of output reference levels.

38. **(Previously amended)** The method of claim **37** wherein generating a set of reference values, one for each of said capacitor switching stages, is performed by a chain of resistors.

39. **(Original)** The method of claim 33 wherein continually switching on one of said small capacitors in parallel to the already switched on capacitors applies to discrete capacitor components.
40. **(Previously amended)** The method of claim 33 wherein continually switching on one of said small capacitors in parallel to the already switched on capacitors applies to capacitors manufactured on a planar carrier, separate from the circuit carrier.
41. **(Original)** The method of claim 33 wherein continually switching on one of said small capacitors in parallel to the already switched on capacitors applies to capacitors integrated on a semiconductor substrate.
42. **(Previously amended)** The method of claim 33 wherein supplying a tuning voltage, dedicated for the voltage controlled capacitance change, to all of said capacitor switching stages uses a single signal connected to all amplifier inputs.
43. **(Currently amended)** A method to control the capacitance of a variable capacitor in a strictly linear mode through a tuning voltage and to achieve a high Q-factor at the same time by sharply cutting off the control signal, when a switching device operates outside its steady ramp-up/ramp-down area; comprising:

providing a set of individual small capacitors, a set of capacitor switching stages, each comprising: a switching device allowing a steady ramp-up/ramp-down phase between the points of being fully switched on and fully switched off, and where said switching device is connected in series with one of said capacitors, to connect a multiple of said capacitors in parallel, a circuit to control the switching operation of said switching device in a ramp-up/ramp-down manner between the points of being fully switched on and fully switched off and comprising, in addition to a translinear amplifier, a first cut-off circuit ~~to take over control of said switching device to drive it to a fully-on status, when said switching device operates outside its steady ramp-up/ramp-down area on said switching device's low resistance side as well as a~~ second cut-off circuit ~~to take over control of said switching device to drive it to a fully-off status, when said switching device is beyond its steady ramp-up/ramp-down area on said switching device's high resistance side, and a~~ common circuit to ~~individually provide~~ a set of input reference levels and output reference levels for ~~each of said capacitor switching stages, and an input signals,~~ dependent on the tuning voltage, and dedicated for the voltage controlled capacitance change ~~and provided to all of said capacitor switching stages;~~

providing an individual input reference level for each ~~individual capacitor~~ switching stage;

supplying one of said signals, dependent on the tuning voltage, dedicated for ~~the~~ a voltage controlled capacitance change, to all of said capacitor switching stages;

amplifying, with said translinear amplifier, the difference of said tuning voltage and said individual input reference level within each capacitor switching stage, to produce ~~the~~ a linear control signal for a ramp-up/ramp-down switching operation;

steadily ramp-up/ramp-down switching on or off said switching device in order to partially switch, with increasing or decreasing share, said small capacitor in parallel to the already switched on capacitors, one after the other, to linearly increase or decrease the total capacitance;

linearly controlling the switching function for each of said switching device with steady ramp-up/ramp-down phase, when said switching device is in its steady ramp-up/ramp-down area;

~~driving said switching device to a fully-on status~~ activating said first cut-off circuit, when said switching device operates outside its steady ramp-up/ramp-down area on said switching device's low resistance side and thus taking over full control of said switching device by driving it to a fully-on state; and

~~driving said switching device to a fully-off status~~ activating said second cut-off circuit, when said switching device is beyond its steady ramp-up/ramp-down area on said switching device's high resistance side, and thus taking over full control of said switching device by driving it to a fully-off state.

**44. (Previously amended)** The method of claim 43 wherein driving said switching device to a fully-on status, when said switching device operates outside its desired steady ramp-up/ramp-down area on said switching device's low

resistance side uses additional circuit elements, working as a signal cutoff function.

**45. (Previously amended)** The method of claim **43** wherein driving said switching device to a fully-off status, when said switching device operates outside its steady ramp-up/ramp-down area on said switching device's high resistance side uses additional circuit elements, working as a signal cutoff function.

**46. (Currently amended)** The method of claim **44** wherein said signal first and/or second cutoff function to drive said switching device to a fully-on status, when said switching device operates outside its steady ramp-up/ramp-down area on the low resistance is implemented within said translinear amplifier.

**47. (Currently amended)** A method to control the capacitance of a variable capacitor in a strictly linear mode through a tuning voltage and to achieve a high Q-factor at the same time and to compensate the temperature deviation of the capacitor switching device; comprising:

providing a set of individual small capacitors, a set of capacitor switching stages, each comprising: a switching device with steady ramp-up/ramp-down phase to continually switch on said capacitors in parallel, a circuit to control the switching operation of said switching device and comprising a translinear amplifier, a temperature compensating circuit to compensate the temperature deviation of said switching device, and a common circuit to individually provide set of input



reference levels and output reference levels for each individual capacitor switching stage, ~~and an input signals~~, dependent on the tuning voltage, and dedicated for the voltage controlled capacitance change ~~and provided to all of said capacitor switching stages~~;

providing an individual input reference level and an output reference level for each individual capacitor switching stage;

supplying one of said signals, dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, to all of said capacitor switching stages;

amplifying, with said translinear amplifier, the difference of said tuning voltage and said individual input reference level within each capacitor switching stage, to produce a linear control signal for a ramp-up/ramp-down switching operation;

continually switching on one of said switching devices with steady ramp-up/ramp-down phase in order to switch one of said small capacitors in parallel to the already switched on capacitors, one after the other;

linearly controlling the switching function for each of said switching devices with steady ramp-up/ramp-down phase; and

compensating the temperature deviation of said switching device, using said temperature compensating circuit to compensate the temperature deviation of said switching device and providing a compensated output reference level to said circuit to control the switching operation.

**48. (Original)** The method of claim **47** wherein compensating the temperature deviation of said switching device is provided by feeding a modified reference voltage to said translinear amplifier's output reference point, to mirror a temperature correcting signal into the control signal of said switching device.

**49. (Original)** The method of claim **48** compensating the temperature deviation of said switching device, uses a device of the same type as said switching device itself, to produce an exact equivalent of said temperature deviation.

**50. (Previously Canceled)**

**51. (Previously amended)** The method of claim **33** wherein individually providing said input reference levels for each individual capacitor switching stage generates a set of reference values, one value for each capacitor switching stage in a non-linear relation between said tuning voltage and said input reference levels.

**52. (Previously amended)** The method of claim **51** wherein providing a non-linear relation between said tuning voltage and said input reference levels is provided by specifically selecting the steps of said set of reference values in a way, to achieve said desired non-linear relation.